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The Use of
MACHINERY
IN
CUTTING
CORN



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CORN-CUTTING MACHINERY, while it does not reduce materially the actual cost of cutting, enables the farmer to cut a given acreage so much more quickly than by hand that the use of such machinery often proves very profitable. Since the proper time for cutting corn is so limited, and other work is usually pressing at that season, the saving of time in cutting may mean much more in the farmer's pocket than could any possible saving in cost of cutting.

The saving in cutting corn for silage is greater than when it is cut for fodder, and the use of machinery renders it possible to secure a greater proportion of the crop when it is in the best condition.

This bulletin discusses the corn binder and the platform harvester, points out the conditions under which they may be used to the best advantage, and gives the disadvantages of their use as well.

Contribution from the Office of Farm Management

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THE USE OF MACHINERY IN CUTTING CORN.

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CUTTING CORN by hand is such a big job and the time available for doing it is so limited that on most farms extra help must be employed for this work. Corn-cutting machinery could be used to advantage on many such farms.

The corn plant is so tall and heavy, and is so easily blown down and tangled when it is nearly mature, that it has been impossible to perfect machines which will cut it satisfactorily and at a low cost under all conditions. However, there are two types of machines, namely, the corn binder and the platform harvester, which do good work under most conditions. The saving in labor and expense effected by their use is not so great as in the case of many other labor-saving farm machines; however, they reduce somewhat the man labor required, and make the work easier than when done by hand. When all the factors of cost are considered, the direct cost of cutting corn either for fodder or silage with either of these machines is very little, if any, lower than that of cutting by hand, but the saving in time is considerable. The time for cutting corn is limited to a few days if the full feeding value of the fodder is to be realized; it may be difficult or impossible to secure enough help to do the work by hand at the proper time; fall plowing, seeding of winter wheat, and digging potatoes must be done on many farms at about the same time as corn-cutting. In such cases the saving of time is of vital importance, and the timeliness and ease of accomplishing the work should be the determining factor in deciding whether to use corn-cutting machinery.

THE CORN BINDER.

This machine has been on the market in very nearly its present form for over 20 years, and in the Middle West it has come to be used generally for cutting corn both for fodder and silage. Corn binders are now manufactured by several firms, and have been in use so long and under such widely differing conditions that they are perhaps as nearly perfect as it is possible to make this type of machine.

A DAY'S WORK FOR A CORN BINDER.

Under normal conditions a corn binder drawn by three horses should cover about 7 acres in a 10-hour day. If the corn is planted in rows 42 inches apart it takes $2\frac{1}{2}$ miles of travel to cover an acre and about 18 miles to cover 7 acres. This is at the rate of a little less than 2 miles per hour for 10 hours and should not be difficult of accomplishment unless the corn is very heavy or conditions otherwise unfavorable. If the machine is working well, the corn all standing upright, and if the team walks fast, the accomplishment may easily exceed this figure by an acre or two. On the other hand, it may happen that heavy or tangled corn and a little machinery trouble will reduce the acreage for a particular day considerably below 7 acres. Some farmers use only two horses on the corn binder, but it is a heavy load for two horses and such an outfit does not generally cover as much ground as when three horses are used. Other farmers find that the use of four horses in heavy corn or on hilly land results in an increased acreage. In cutting corn for fodder two men will ordinarily be able to keep up with the binder in shocking if a bundle carrier is used to reduce to a minimum the amount of carrying which the men must do. This makes 7 acres a normal day's work for three men when aided by a binder in cutting and shocking corn.

COST OF USE.

The machinery cost to be charged against each acre cut with the binder depends upon the first cost of the binder, the number of years of service it will give, the number of acres cut each year with it, and the amount spent for its upkeep and repair. The most reliable figures on the cost of using corn binders are those given in Department Bulletin No. 338, "Machinery Costs of Farm Operations in Western New York," and although they apply to a limited area only, they may be accepted as giving a fairly definite idea of what may be expected of one of these machines. In this locality the average corn binder lasts about 11 years, but during that time does only about 40 days' actual work. There is no doubt that it could render several times this much service before wearing out if there were more work per year for it to do. There seems to be very little relation between the amount of work done annually and the years of service. The cost per day used or per acre cut is very nearly in inverse ratio to the ground covered annually. Out of 458 binders on which data were obtained in that region, 233 cut 15 acres or less annually at a cost of \$9.78 per day used and \$1.67 per acre. The remaining 225 cut over 15 acres annually, averaging $32\frac{1}{2}$ acres, at a cost of \$3.24 per day of service and 57 cents per acre. The original cost of one of these binders was about \$125. Thus, if there will be

only two or three days' work for the binder to do each year, the cost of cutting corn with it will be so great that its use is not advisable unless it is absolutely impossible to cut corn by other methods without seriously neglecting other work. However, if two or three neighbors, each of whom has only a small crop, unite in the purchase and operation of a corn binder, both the cost of operation per acre and the first cost of the machine to the individual farmer will be greatly reduced. One farmer owning the binder sometimes cuts for other farmers, they furnishing the team.

POSSIBLE OBJECTIONS AND DIFFICULTIES.

The greatest objection to providing expensive machinery for cutting corn is that in some years the corn is blown down and tangled so badly at cutting time that the only way to save the stalks at all is to cut by hand. It is impossible to tell how often the corn crop will be in such shape at cutting time that a binder can not be used in it, and if a person has only a moderate acreage to be cut, this question should have careful consideration in deciding whether to buy such an expensive machine. However, if the farmer has a large corn acreage, or if the binder is bought cooperatively by two or more farmers, the machine may be a paying investment even if it stands idle one year out of every four or five.

Other objections to the corn binder sometimes made, but which are generally less serious or negligible, are that the binder knocks a great many ears off the stalks, that the bundles are harder to handle than the loose stalks, that it is impossible to do a good job of shocking after a binder, and that the fodder in tightly bound bundles does not cure well.

A binder has never been constructed which will not knock some ears off the stalks as they are being conveyed from the cutter bar to the binder head, and it is often profitable to send a man over the field to pick up these ears after the cutting is done. It is not generally a very big or hard job, but it is always annoying to be compelled to do such work as this after a machine.

A person handling for the first time the bundles made by a binder generally finds them heavier than the armful of loose stalks he has been accustomed to carrying. However, a given amount of stalks can be handled with less expenditure of energy if they are in bundles of this size than if they are loose, and persons who have become accustomed to handling the bundles do not like to handle loose stalks at all.

While it may be true that under adverse conditions the fodder does not cure quite as well in the bundles as when loose, if there were any very great difference in quality the binder certainly would not continue in general use. The only reason for cutting the corn at all is to get the full feeding value of the stalks, and any method which de-

creases appreciably the value of this forage would not be adopted to the extent that the binder has been.

In some localities where the shocks are to be set in rather widely separated rows, it is customary to go through the field in advance of the binder and tie four hills or stalks together to make the "stool," "saddle," or "gallows" for supporting each shock and cut the remainder of the two shock rows with a corn knife. This provides a substantial support for the shocks, but requires considerable hand labor. Another plan is to have a movable wooden horse or "tree" around which to build the shocks. When this latter plan is followed no cutting by hand is necessary. However, where two men work together in shocking, it is possible to start and build the shocks in much the same manner that wheat and oats shocks are built without any support whatever. Care in building and tying will generally prevent such shocks from falling down or being blown over. Many farmers who build large shocks have found this method satisfactory.

A rather troublesome feature of cutting corn with some makes of binders is that the bundles are dropped so nearly behind the machine that the horses have to walk over them on the next round. When a bundle carrier is used the three or four bundles in a bunch make such a large pile that it is almost impossible for the horses to step clear over them, and when they step on the bundles the bands are often severed and ears broken from the stalks. This is an especially bad feature when a tractor is used for propelling the binder. On account of this trouble some farmers do not use a bundle carrier at all, though dropping the bundles one at a time promiscuously around the field increases considerably the labor of shocking or loading the wagons to haul to the silo. This difficulty has finally been overcome by the perfection of a bundle carrier in the form of a short conveyor, which delivers the bundles far enough to one side to be out of the way of the horses or tractor on the next round. This carrier is now furnished regularly with some makes of binders.

GAIN OVER HAND METHODS IN CUTTING CORN FOR FODDER.

When a corn knife is used, one man seldom cuts and shocks over an acre and a half per day even under the most favorable conditions. If the corn is tall and the yield heavy, 1 acre is generally considered a good day's work. A fair day's work for one man in cutting and shocking corn by hand in western New York, as reported in United States Department of Agriculture Bulletin No. 412, is about 1.1 acres for ordinary yields. Three men, then, should cut and shock 3 to 4 acres per day.

In the same locality a normal day's work for a corn binder and three horses is a little less than 6 acres, and for a man setting up corn after a binder a little more than 3 acres. The actual accomplish-

ment will vary considerably, and in other sections the binder usually covers 7 acres or more in a day. Two men generally work together to set up the corn. Thus three men with a corn binder, one to drive and two to shock, will cover 6 to 7 acres while three men cutting by hand do 3 to 4. It is not nearly as hard work to drive the binder as it is to cut and shock an acre of corn in a day, and often the services of a boy or old man, who would be inefficient in cutting by hand, can be utilized for this purpose. Ignoring this possible advantage, it takes three men only a little over half as long to do a given job with a binder as it would take them cutting by hand. (See fig. 1.)

In order to make the use of the binder worth while, the reduction in labor and the saving due to getting the work done at the proper



FIG. 1.—A binder cutting corn for fodder. Practically all the corn grown in some sections is cut, either for fodder or silage, and on many farms the work is all done by hand. Machinery could be used profitably for this work on many of these farms.

time must more than pay for the use of the machine, the twine, and the labor of the horses. If the fodder is to be run through a husker shredder or hauled to the feed lot before it is husked there is some advantage in having it in bundles, and this gain may be more than enough to offset the value of the twine used. However, if the fodder is to be husked by hand in the field there is little advantage in having it bound, because the bands must be cut without the fodder ever having been handled except to set it in the shock.

Suppose that a farmer has 40 acres of corn to cut for fodder. Using the same figures as above, three men with the binder could do the work in 6 days, while if the old-fashioned corn knife were used it would take them 10 days. This makes a difference of 12 days man

labor to pay for the labor of the horses, the machinery cost, and the twine. Under ordinary conditions 2 to 3 pounds of twine per acre, approximately 100 pounds for the 40 acres, will be necessary. For this acreage the annual charge for interest, depreciation, and repairs to the machine should be about 15 or 20 per cent of its first cost. The charge for horse labor will vary greatly, and many farmers ignore this item entirely on the ground that the horses are necessary for other work at other times of the year and would be doing nothing at this time if they were not used on the binder. At normal prices the cost of the twine, together with the cost of the use of the binder, without considering at all the cost of power, will be about as great as the value of the man labor saved if the binder is used in cutting 40 acres for fodder every year. It is thus seen that little or no direct saving in money results from the use of a corn binder in cutting corn for fodder, even on a large acreage. The indirect saving, due to getting the work done more quickly than when the hand method is used, can not be estimated, but in some seasons it is undoubtedly an important consideration.

GAIN OVER HAND METHODS IN CUTTING CORN FOR SILAGE.

There is a greater saving when a binder is used in cutting corn for silage than when it is cut for fodder, and the binder has accordingly found the greatest favor among the farmers who put up a large amount of silage.

One binder will usually be able to cut the corn as fast as a 12 or 14 inch ensilage cutter can handle it. For ordinary yields such a cutter will handle approximately an acre of corn per hour if kept running steadily. It is a common practice, even though the capacity of the cutter is no greater than that of the binder, to have the binder cut a few acres before the ensilage cutter is started, so that slight delays of the binder will not cause corresponding delays on the part of the remainder of the crew.

The corn has a tendency to lose a great deal of moisture if left on the ground for more than a few hours. This loss of moisture may impair the quality of the ensilage, and the corn should never be left on the ground long enough to become badly wilted or dry.

In cutting corn and placing it in small bunches on the ground a man can cover a somewhat greater area than in cutting and shocking, but at least three men with corn knives would be necessary to equal the performance of a binder. (See fig. 2.) The person who is accustomed to handling only a few loose stalks at a time may think that loading and unloading bundles is much harder work, but, nevertheless, there is a considerable saving in time in handling corn that has been cut by the binder. Under some conditions at least it takes

fully twice as long to unload at the cutter a given quantity of corn when loose as when in bundles. (See Farmers' Bulletin No. 292, "Cost of Filling Silos.") There is a similar saving in picking up the bundles from the ground and loading the wagons in the field.

Thus the binder saves the labor of at least two men in cutting corn for silage as compared to hand work. Often the saving in time due to the corn being in bundles instead of loose will enable the operator further to reduce the size of the crew. Of course, if only a small amount of silage is to be put up, and it can be done with the regular farm help and a small silage cutter, a binder would not be a paying operation, unless there is a large amount of other corn to cut.

Sometimes the binder to be used with a cooperatively owned cutter is also cooperatively owned and occasionally the man who runs a



FIG. 2.—Cutting corn for silage by hand. In cases like this, where several men are necessary to cut the corn by hand fast enough to supply the silage cutter, binders could be used advantageously unless labor is very plentiful and cheap.

custom outfit supplies the one or two necessary binders as a part of the outfit. Where the only corn cut is that for silage, such practices are to be recommended, for they give the individual farmers all the benefits of the use of the binder at a cost that is a great deal less than if each owned his own machine.

THE BUNDLE ELEVATOR.

It is now possible to purchase for nearly all makes of corn binders bundle elevators, which deliver the bundles directly to a wagon driven alongside the binder. The principal objection which men have to working with a corn binder is that the bundles are heavy and lifting them on to the wagon is very hard work. The bundle elevator adds but little to the draft of the machine and does away altogether with this work. (See illustration on title-page.)

Where the bundles are dropped from the binder to the ground, two men are generally required to hand them up as fast as one man can arrange them on the wagon. When an elevator is used, one man usually arranges the bundles on the wagon as they are delivered from the binder and another man or boy, if available, drives the team. With a team that is easily handled it is sometimes possible for the teamster to do his own loading and thus dispense with one other member of the crew.

The principal drawback to the use of the elevator is that the binder may not be quite able to keep the ensilage cutter supplied with corn, and some time will be lost unless a part of the corn is cut before starting to fill the silo. This, of course, must be loaded by hand. Then, too, there is necessarily some loss of time through the binder having to wait for a wagon, or vice versa, and whenever the binder stops the men and team on the wagon will be idle. However, if conditions are such that the corn can be cut at approximately the same rate that it is handled by the ensilage cutter, a bundle elevator attached to the binder will replace at least one man. On many farms where silo filling extends over several days and a large crew is employed, the elevator can be used to advantage.

THE PLATFORM HARVESTER.

The first successful corn harvesters were of the sled or platform pattern, and though the perfection of the binder has made it the most popular machine for cutting corn, many platform harvesters are still in use and many farmers think them the most satisfactory machines for cutting corn.

This machine is a sled platform or a platform mounted on small wheels, which carries knives to cut the stalks. The first ones were homemade affairs mounted on sled runners, but the saving in draft is generally enough to warrant the use of wheels, and nearly all of those on the market are mounted in this manner.

The ordinary form of platform harvester is pulled by one horse and cuts two rows at a time. (See fig. 3.) Two men ride on the platform to catch and support the stalks as they are cut. In cutting corn for fodder, the horse is stopped when the shock is reached, the men carry the cut corn to the shock, return to the cutter, and start for the next shock.

DAY'S WORK OF A HARVESTER.

A normal day's work for two men, one horse, and a harvester of this kind in cutting and shocking corn for fodder as reported in Department Bulletin No. 3, is about 4 or 5 acres. The actual accomplishment depends to a considerable extent, of course, on the yield

and condition of the corn and the distance the cut corn is carried. If one of these machines could be kept moving steadily at the rate of 2 miles an hour for 10 hours, it should cover something like 15 acres, and the reduction from this figure is the time lost by stopping the machine while the corn is carried to the shock. If the shocks are placed in widely separated rows so that there is a great deal of carrying to be done, it may be possible to use more than two men profitably with each cutter, and thus keep the machine moving practically all the time. Under ordinary conditions, however, the most efficient method is probably to have two men to each harvester. The machine is not a costly one, and if work is not done fast enough by two men it will generally be profitable to provide an extra machine as well as more men.

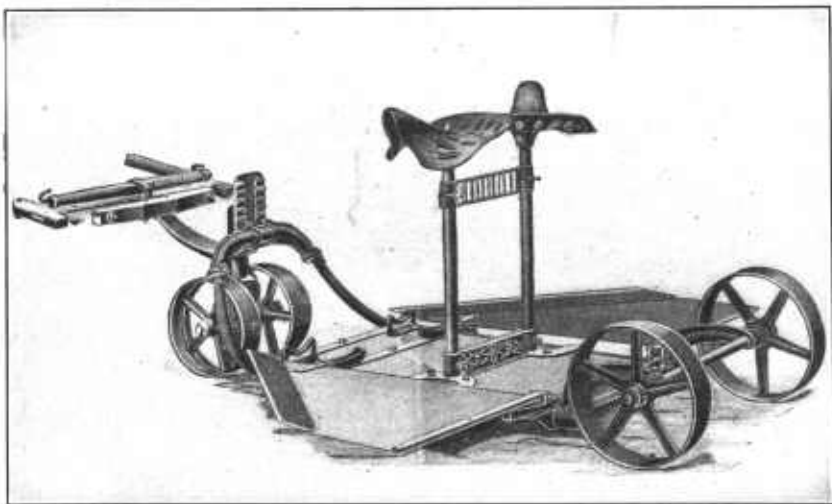


FIG. 3.—A two-row platform harvester, with knives on hinged wings so that either can be lifted to pass obstructions.

The acreage covered in a day by a platform harvester in cutting corn for silage depends largely on individual farm practice. For the most efficient work, the wagons used in hauling to the silo should be driven alongside the harvester while it is at work so that the cut corn can be placed directly on the wagons. It takes little if any more time to put the corn on the wagon thus than it does to place it in piles on the ground in such a way that it can be picked up easily. Thus nearly all the time and labor that otherwise would be required for picking up from the ground and placing on the wagon is saved. In a test at the Nebraska Experiment Station Farm, as reported in University of Nebraska Bulletin No. 145, it was found that approximately 5 acres of corn yielding 8 tons of silage per acre constituted a fair day's work for two men in cutting and loading corn in this manner.

COST OF USE.

The first cost of a platform harvester in normal times is from less than \$20 to over \$50, depending on the construction of the machine. In general a platform harvester should last as long as any other simple farm machine if given intelligent care, and since there are few moving parts the repair bills should be low. About the only upkeep expense is that of sharpening the knives, and this is usually done at home. Because of the diversity in price and durability of different makes of this machine, it is impossible to give any conclusive figures as to actual cost of use per acre; it has been variously estimated at from 15 to 50 cents. At the highest the cost of cutting with a platform harvester will be but a small fraction of that of a corn binder, covering the same acreage annually.

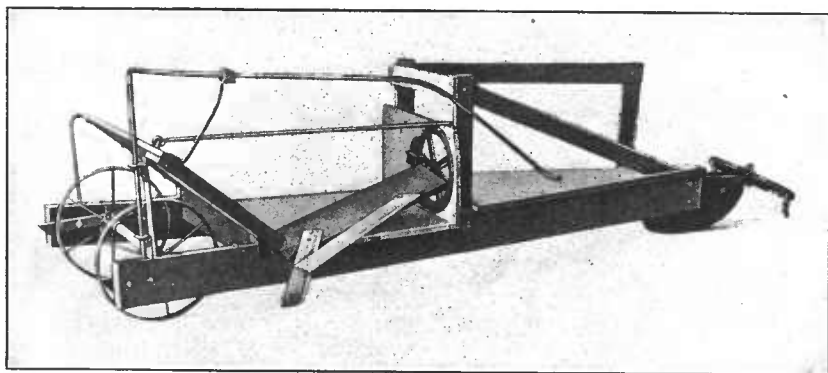


FIG. 4.—A one-row platform harvester. With this inexpensive machine and one horse, a man can do from 50 to 100 per cent more than when cutting with a corn knife.

DIFFICULTIES IN USE OF PLATFORM HARVESTER.

As in the case of the binder, the greatest difficulty in the use of a platform harvester is found when the corn is down and tangled at cutting time. The horse drawing the two-row platform harvester walks between the uncut rows, and will break and trample some of the corn unless it is all standing well. Since the operators must catch and support all the stalks as they are cut, it is hard, slow work for them if the corn does not stand straight and even. At the best the horse must walk rather fast if the cutting is to be cleanly done, and supporting and carrying the heavy loads of unbound stalks makes the work at least as hard for the men as when cutting by hand.

The most satisfactory way to start the shocks when cutting corn for fodder is generally to make stools or saddles for supporting the shocks by tying four hills or stalks together, and then cut by hand the rows in which they occur before the machine starts to work. Some of the harvesters are provided with devices for starting the shocks

without tying saddles, but it is difficult to build a substantial shock of the loose stalks without some permanent support. Most of the harvesters are provided with hinged cutter boards which may be raised on either side to pass obstructions at any time, and it is possible to use the machine for cutting the rows in which the stools are tied by simply lifting the cutter on the side next to them when they are reached on the first round. But this is necessarily slow work, especially if the shocks are to be set close together. If these rows are all cut by hand, sometimes a fourth or even a third of the corn is cut



FIG. 5.—Cutting corn for fodder with a platform harvester. As compared with cutting by hand, this implement takes the place of at least one man. These two men easily accomplish as much as three men cutting by hand.

before the machine starts to work. It is impossible to use a movable horse or tree, because the shocks are not started and finished one at a time as in the case of cutting and shocking by hand or shocking after a binder.

GAIN OVER HAND METHODS IN CUTTING CORN FOR FODDER.

It is fair to assume that if conditions are favorable, two men with a platform harvester and one horse will cut and shock at least as much corn in a day as three men cutting by hand. (See fig. 5.) If the two men with the harvester cover 4 acres a day, the three men cut-

ting would each have to cover about $1\frac{1}{3}$ acres to equal this performance. The actual performance will vary considerably, but conditions which will increase or decrease the accomplishment of the harvester and crew would probably affect the accomplishment of the hand workers to about the same extent. Then every day that the platform harvester is used about one day's man labor is saved. This saving in labor and the further saving due to being able to get the work done with the same number of men in two-thirds of the time, must offset the cost of the horse labor and the use cost of the machine. The use of the platform harvester on 40 acres of corn for fodder saves something like 10 days' man labor. If the machine takes the place of hired help, one of the cheaper ones will very nearly pay for itself if used on this acreage.

GAIN OVER HAND METHODS IN CUTTING CORN FOR SILAGE.

There is probably greater variation in farm practice in cutting corn for silage with a platform harvester than in cutting for fodder, but whatever the practice followed the gain over hand methods should be at least as great in cutting for silage as it is in cutting for fodder; that is, the efficiency of each man is increased by as much as 50 per cent. If the corn is cut and laid in bunches on the ground, there will be practically no carrying for the men on the harvester to do, and they should cover considerably more ground than when cutting and shocking. If a wagon is driven alongside the harvester and the men load directly on the wagon, the amount of work to be done is just about the same as when cutting for fodder. (See fig. 6.) The corn will be in just about the same shape and be just about as easy to handle on the wagon and at the silage cutter when cut with the harvester as when cut by hand. Horse power does the actual cutting, there is no outlay for twine, the machinery cost is low, and the saving in labor effected by the harvester will be very nearly all clear gain.

The most efficient method is to put the corn directly on to the wagons as it is cut, for this eliminates one handling of it, but one platform harvester and two men can not cut fast enough to keep a very large silage cutter supplied and a second harvester would have to be provided in a good many cases if this method were to be followed.

COMPARISON OF BINDER AND PLATFORM HARVESTER.

In cutting corn for fodder the use of the binder increases the efficiency of each man in nearly the same proportion as does the use of the platform harvester, but it is somewhat harder work for the men with the platform harvester on account of their having to catch the

corn as it is cut and carry large loads to the shock. The platform harvester will probably not work satisfactorily under as wide a range of conditions as will the binder. Even if the corn is down or somewhat tangled, the dividers on the binder will pick up all the stalks except those which are lying flat on the ground and put them into bundles without any extra labor on the part of the driver. It will sometimes be impossible to use a platform harvester with any degree of satisfaction on such corn. However, on account of the low first cost, a platform harvester will often be a profitable investment

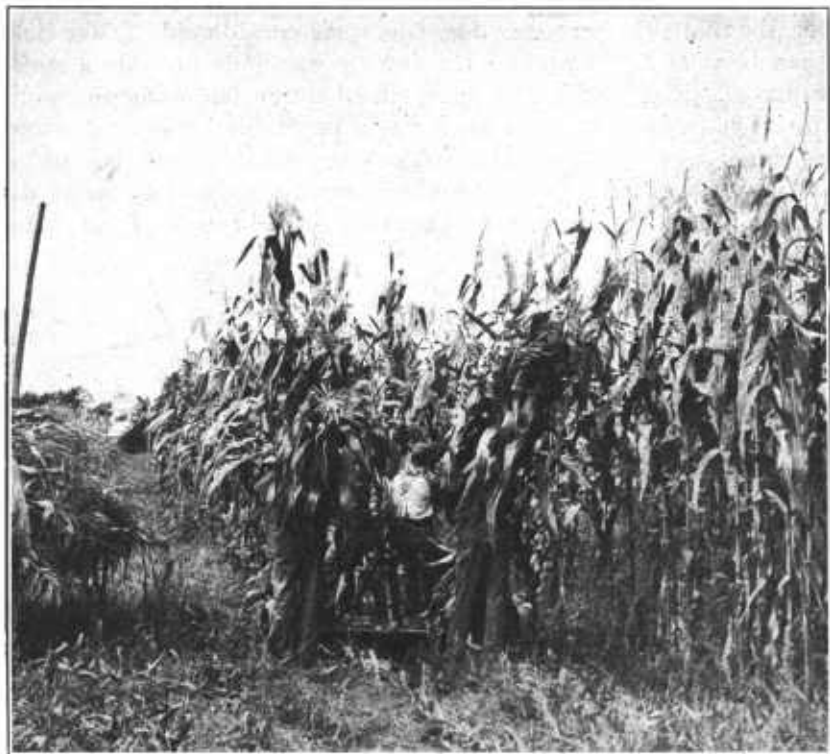


FIG. 6.—Cutting corn for silage with a platform harvester. The two men on the harvester catch the corn as it is cut and pass it to the two men at the rear, who carry it to the wagon, driven alongside.

on the small farm where the amount of work to be done would not justify the purchase of the more expensive binder. Looking at it another way, the platform harvester could stand idle a greater percentage of the time, or wear out sooner than a binder cutting the same acreage for fodder annually, and still be a profitable investment.

The farmer who is contemplating the purchase of either of these machines for cutting corn for fodder only, must decide whether the greater amount of corn cut in a given time and the greater ease in

doing the work that will result from the use of the binder will justify the purchase of this comparatively expensive machine, the use of extra twine required by it, and the hiring of an extra hand to make up the crew. If horses are scarce, or if there is other work for them to do at corn-cutting time, the extra horse labor required by the binder would also have to be taken into account.

In cutting corn for silage the saving in labor effected by a platform harvester will generally not be as great as that brought about by the use of a binder, mostly on account of the fact that the loose stalks require more time and are harder to handle than the bundles. However, the platform harvester does this work considerably faster than it can be done by hand, and the farmer who puts up only a small amount of silage and has a small silage cutter for doing the work will often find one of these machines a profitable investment where the binder would not be. If a large silage cutter is used, the added economy in handling bound corn will usually make the use of the binder preferable, since it would take more than one platform cutter to keep the silage cutter busy.

